

02/14/04
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RSS data quality issues

From the very beginning after deployment in May 2003 we observed several effects that we did not anticipate after the per-deployment lab test. They were:

- (1) Rapid drop in responsivity (slide +1).
- (2) Responsivity having $1/\lambda$ wavelike periodicity (slide +2, +3).
- (3) Appearance of nonlinearity within 3 month (slide +4)
- (4) Larger than expected diurnal wavelength changes and long term drift (subsequent slides)

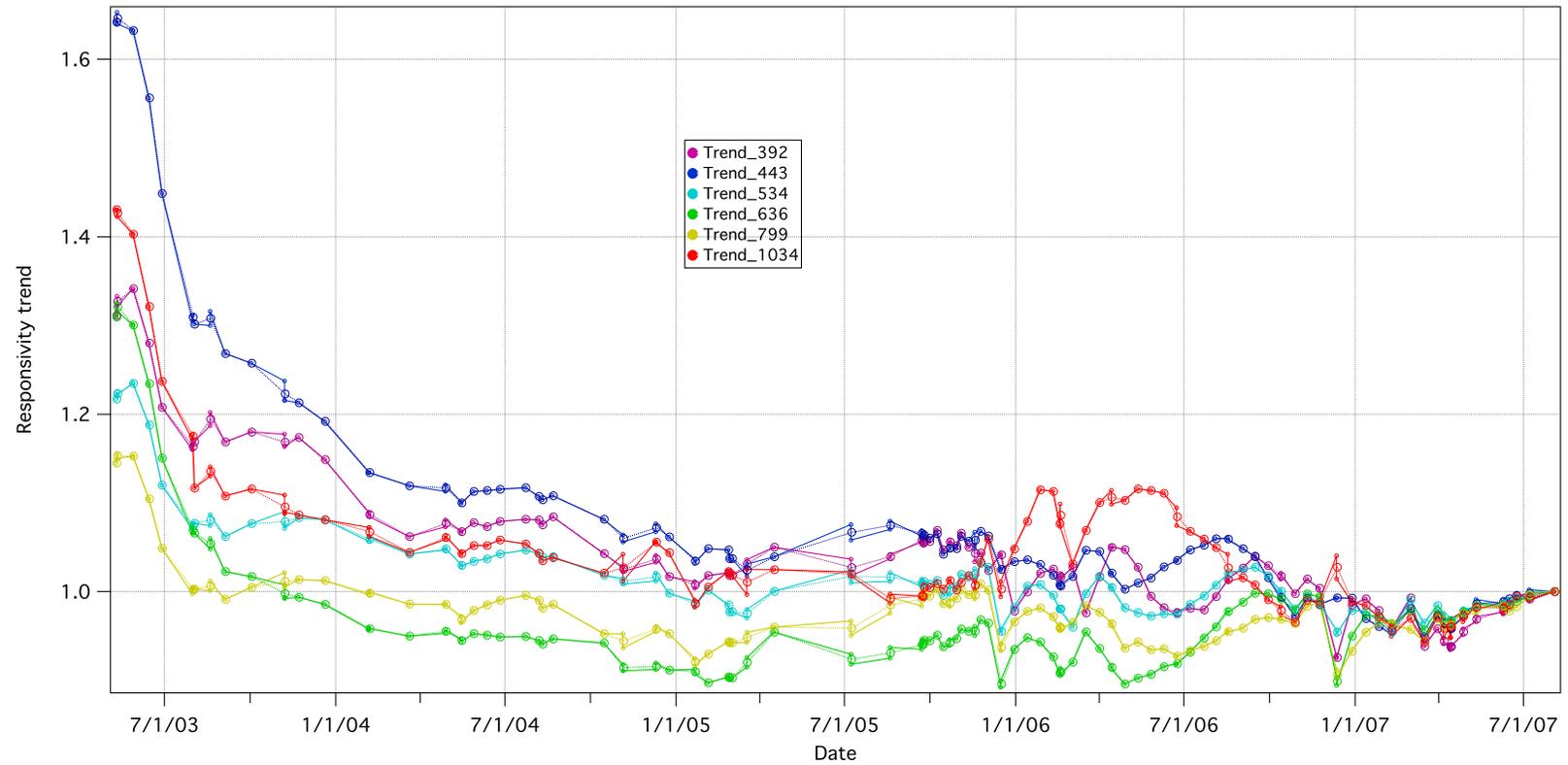
Right away we responded with development of correction algorithms and methods. (1) and (2) is corrected to within 2-3% with biweekly lamp calibrations; (3) Nonlinearity factor is derived from calibration data and applied in correction; and (4) is efficiently corrected with Fourier correlation algorithm applied to every spectra (once a minute).

Furthermore we perform Langley regression processing (not a part of official data stream) that corrects longer term drifts in responsivity. The results are available via RSS web page.

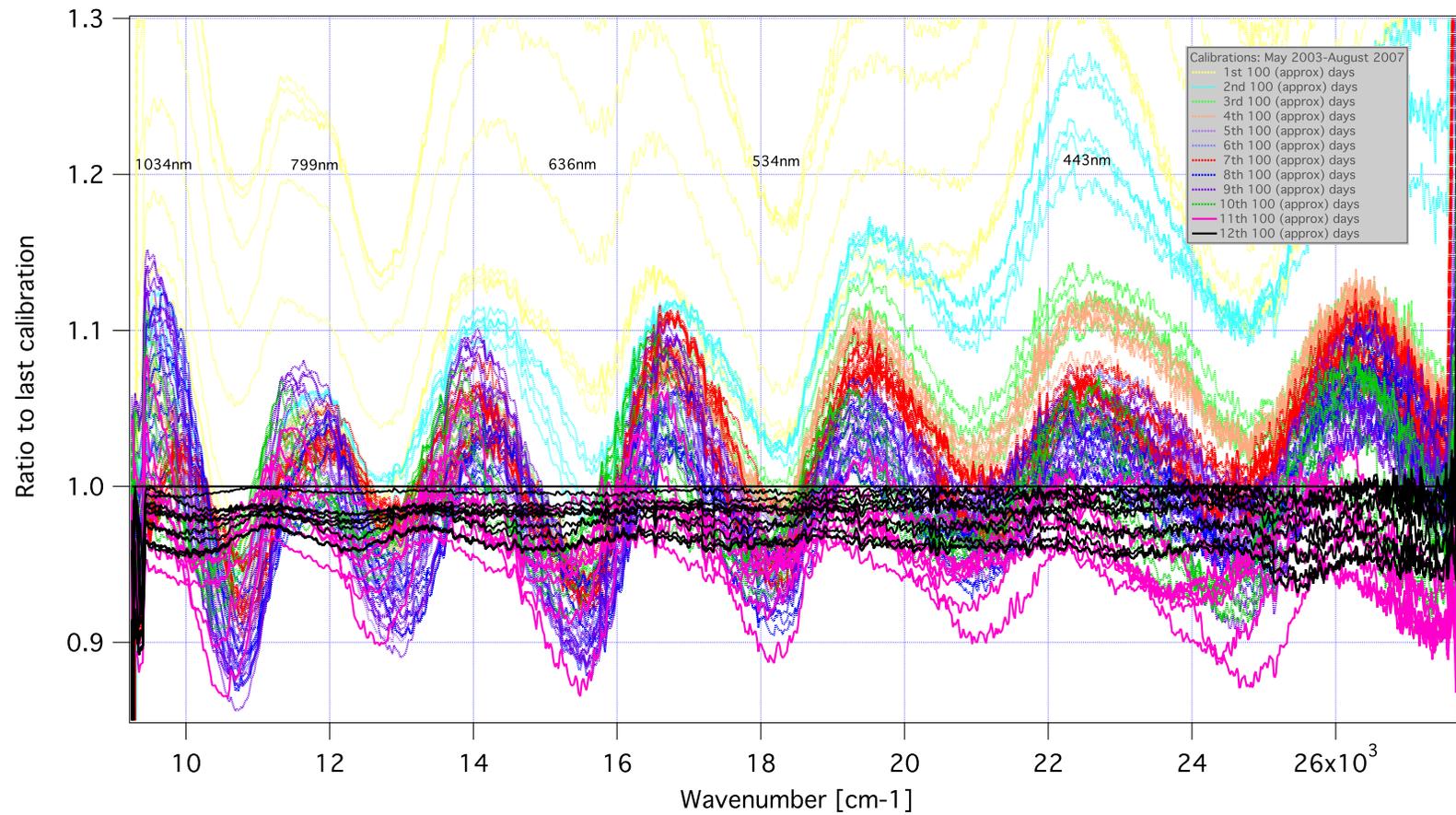
We have several hypotheses to explain (1), (2), (3) and (4). In the planned overhaul of RSS we intend to perform the following tasks:

- (a) Post deployment RSS lab characterization (responsivity, CCD image, cosine response)
- (b) Opening up optics for evaluation: cleaning, possible replacement of CCD, repositioning dynamic range suppression filters,
- (c) Tuning (old or new) CCD for best linearity
- (d) Providing constant pressure valve for purge to reduce out gassing problems (optics is sealed currently)
- (e) Pre-redeployment RSS lab characterization.

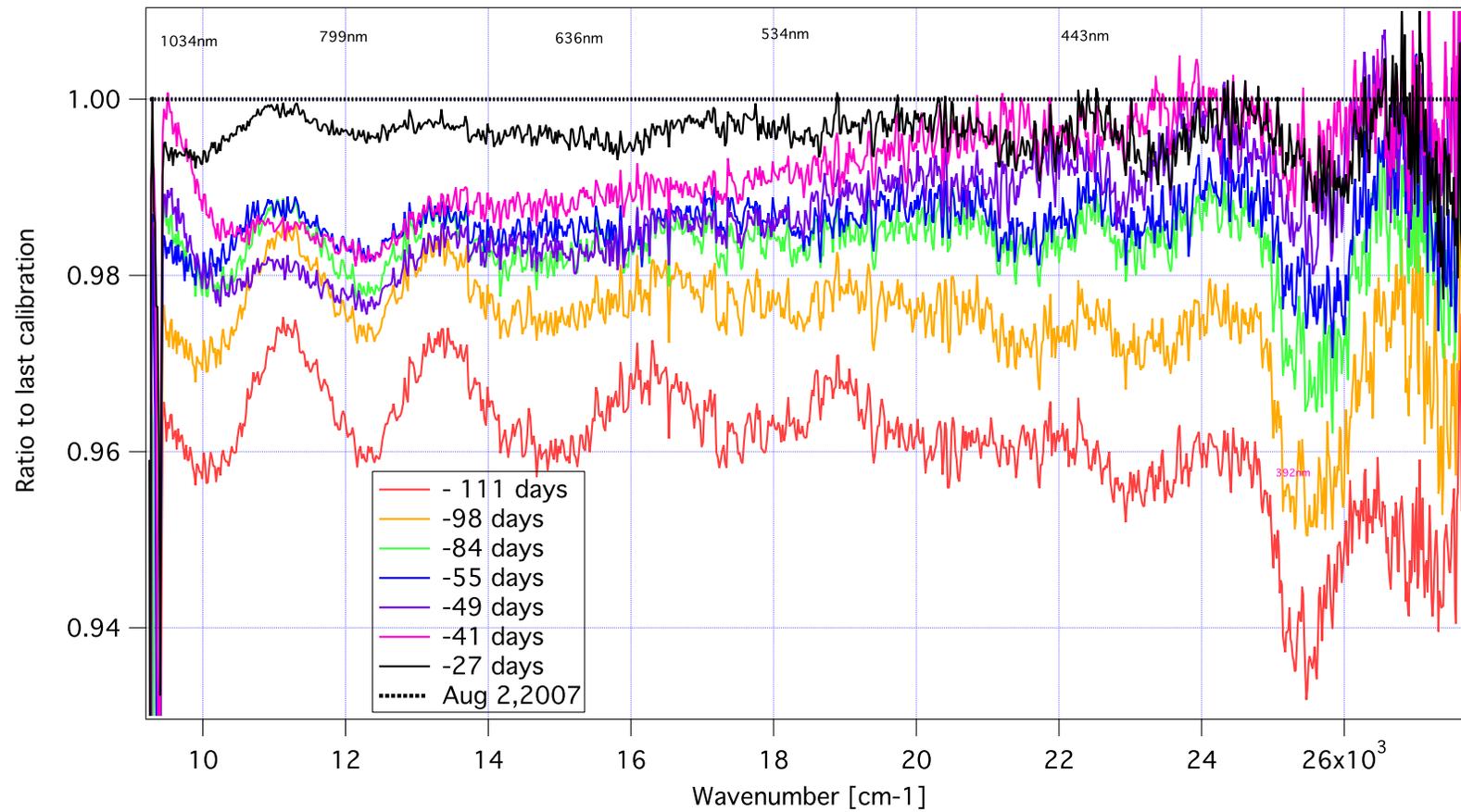
Responsivity Trends in Over 4 Years



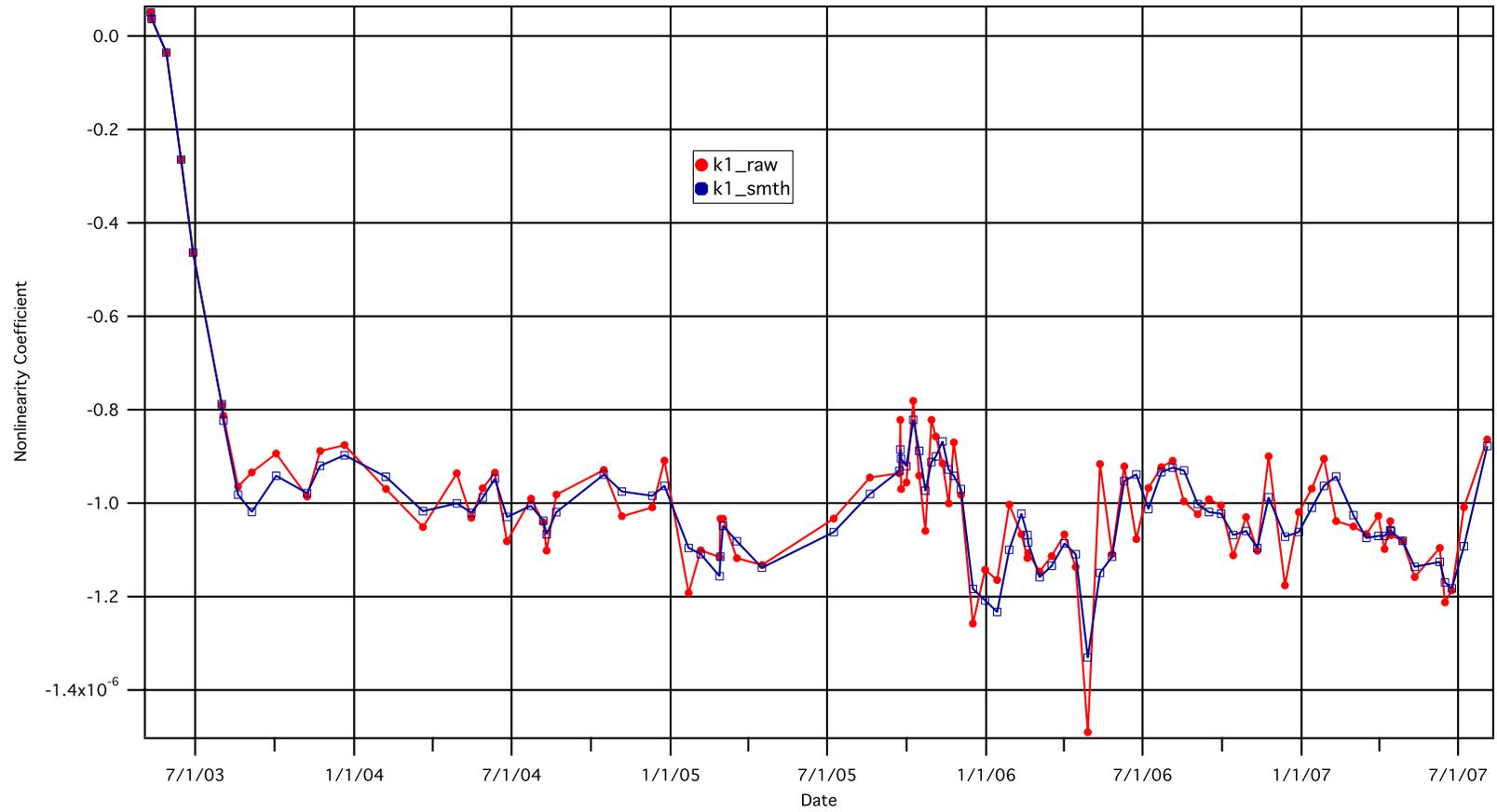
All 138 Responsivities Normalized by The Last



Responsivities In Last 111 Days

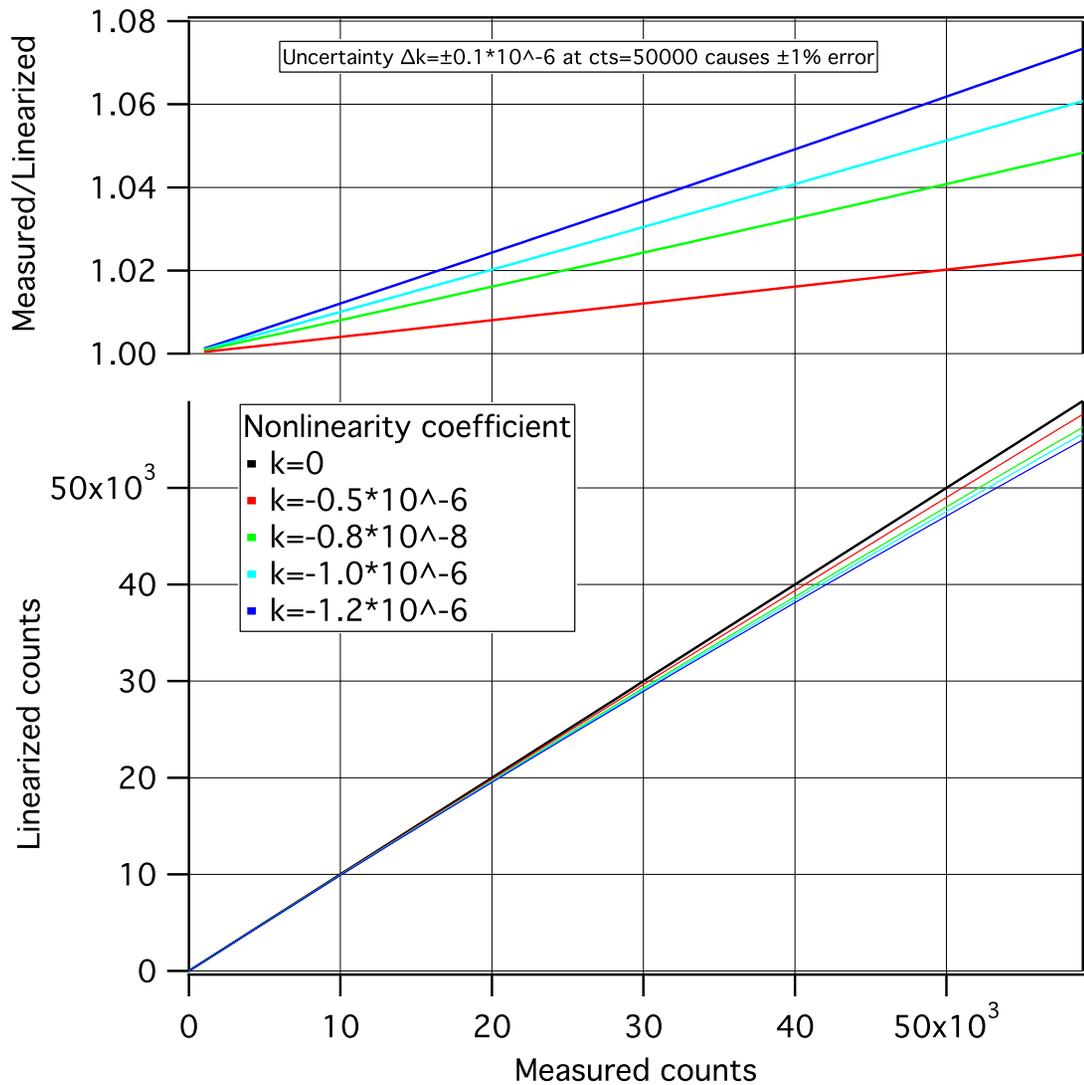


Nonlinearity Coefficient Trend

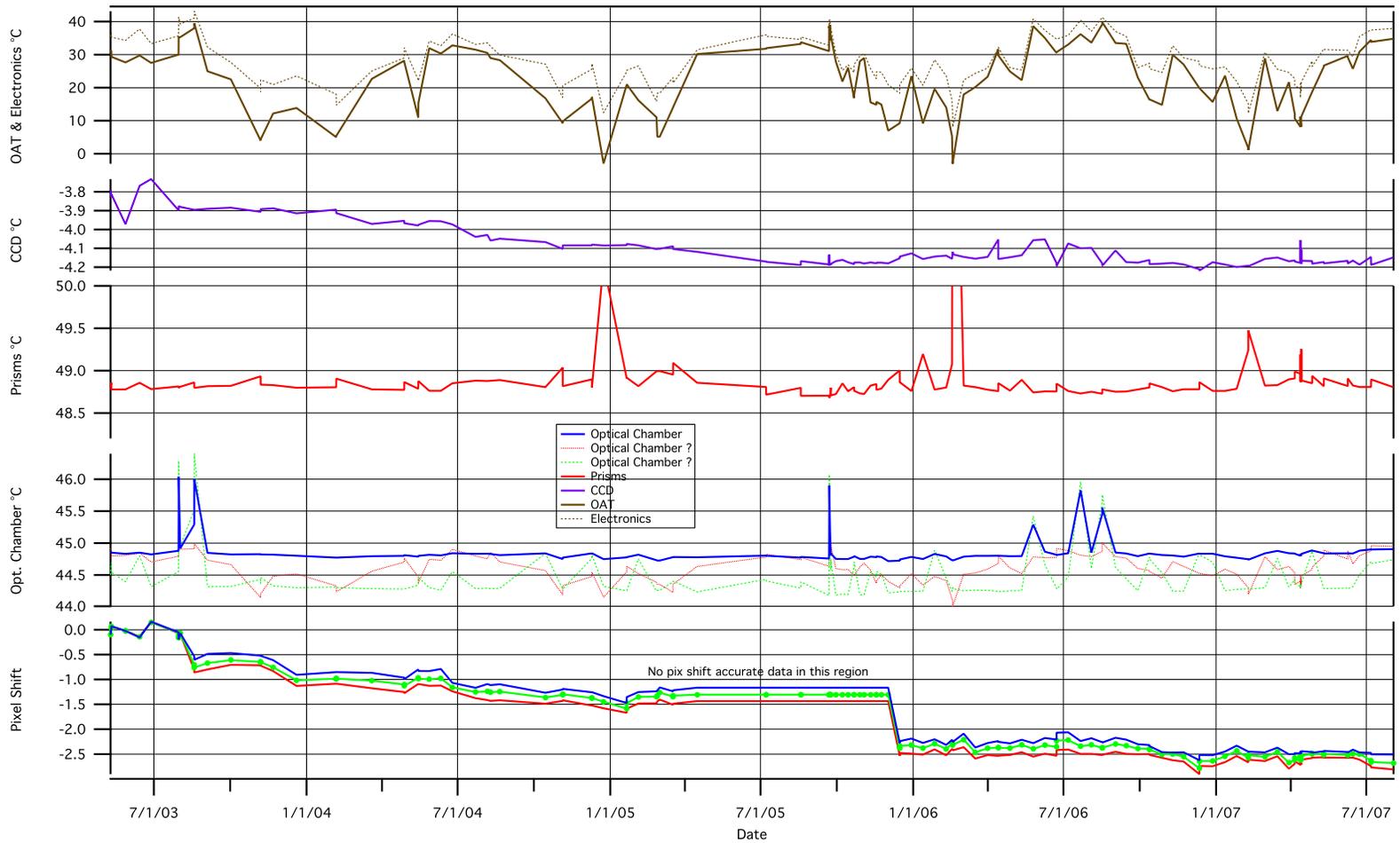


Nonlinearity Effect

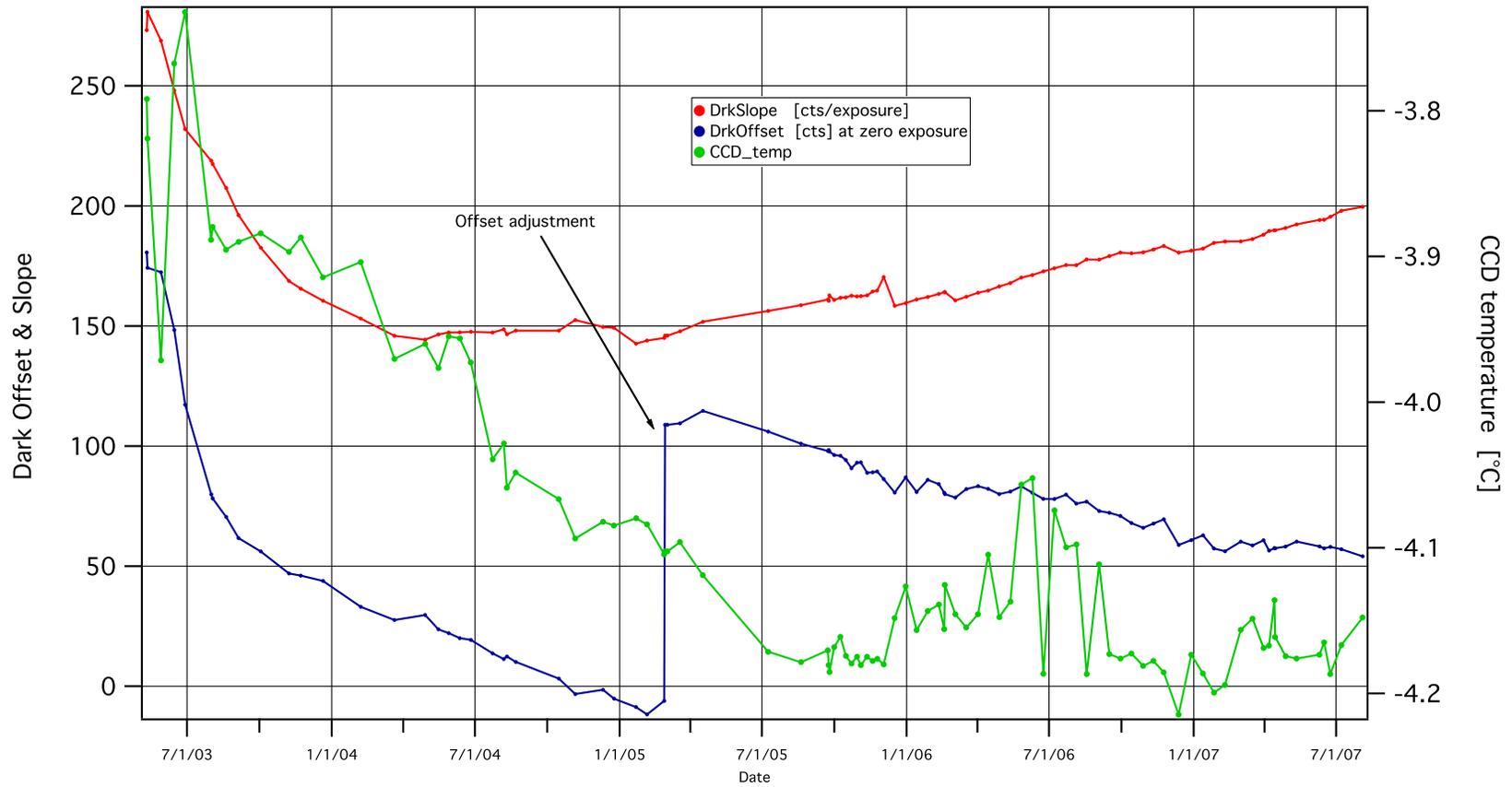
$$C_{\text{linearized}} = C_{\text{measured}} \cdot \exp[k \cdot C_{\text{measured}}], \text{ where } k \text{ is negative for RSS105}$$



Pixel Shift Trend and Temperature History (during 138 calibrations)



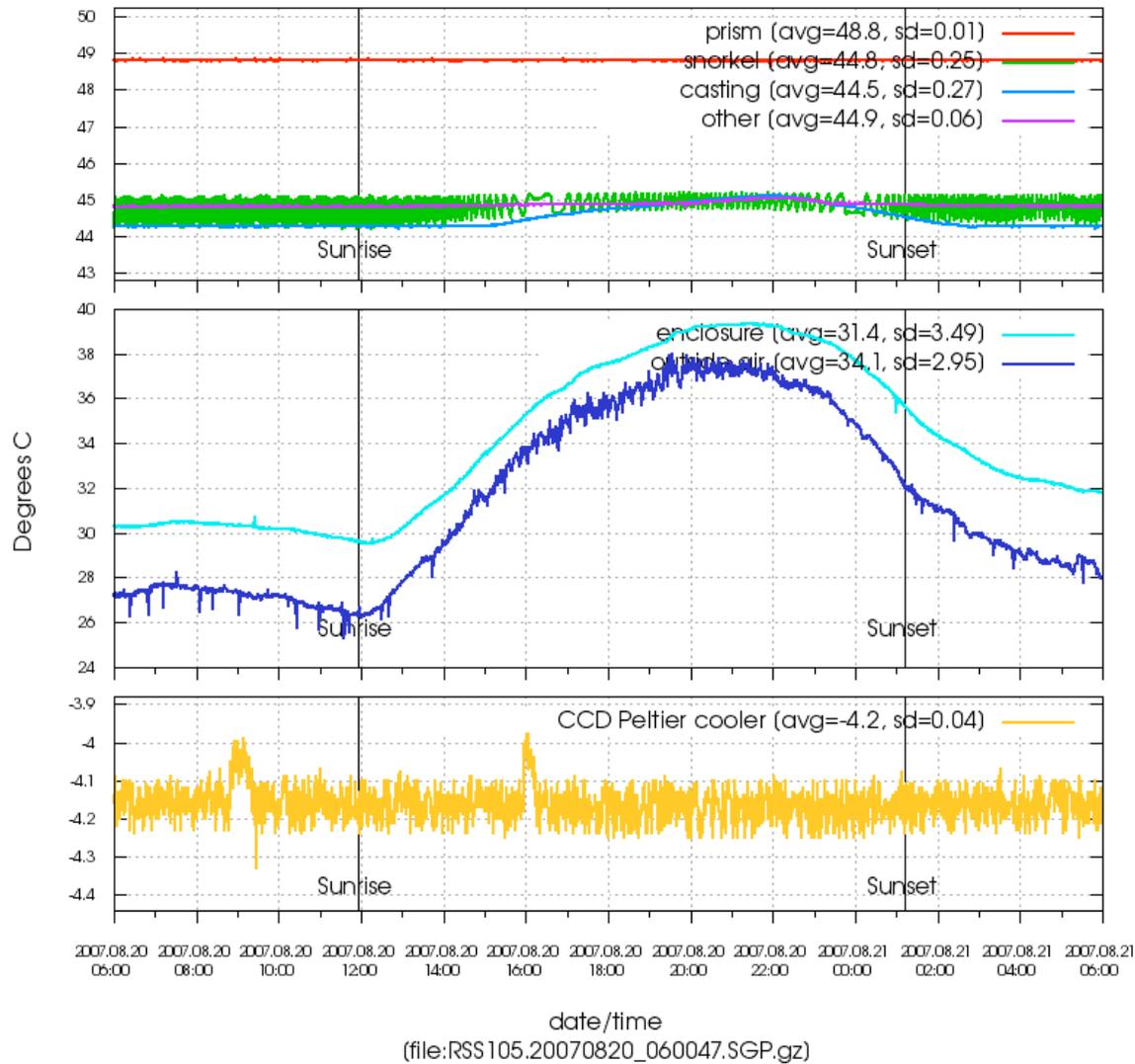
Dark Trends and TEC temperature



Daily Temperature Changes

For daily QC plots see: <http://plot.dmf.arm.gov/plotbrowser/>
and then select Search Site "SGP", Datastream "sgprss", "Thumb" and press Get Plots

RSS105 Temperatures From Raw Data File



Daily Pixel Shifts

For daily QC plots see: <http://plot.dmf.arm.gov/plotbrowser/>
and then select Search Site "SGP", Datastream "sgprss", "Thumb" and press Get Plots

RSS105 Fraunhofer Shifts

